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NOTES ON THE BIOLOGY OF THE DOUGLAS FIR BEETLE IN THE CENTRAL ROCKY MOUNTAIN REGION

By

Donald De Leon

Forest Insect Laboratory,
Fort Collins, Colorado,
February 26, 1940

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SUBJECT—

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INTRODUCTION

As little was known of the biology of the Douglas fir beetle (Dendroctonus pseudotsugae Hopk.) in this region, what little time that could be spared from work on the Black Hills beetle last summer was spent in a study of the Douglas fir beetle in a small infested area in the North St. Vrain Canyon east of Estes Park, Colorado.

A few tree cages of the same two types that were used last season in the Black Hills beetle study were erected and collections made from them and other observations recorded as time permitted. Most of this field work was done by W. L. Howe and R. T. Stevenson.

SEASONAL HISTORY AND HABITS

Emergence Period

Emergence of the overwintering new adult beetles occurs as early as the middle of May and continues throughout the summer. Apparently some also overwinter a second season. Most of the beetles emerged from the tree attacked the previous year by the fourth of July. Table I shows the emergence records for three cages erected on June 6. No emergence occurred in these cages until June 13 but this retarded emergence was probably due to the cooler location of the trees. Three newly attacked trees with galleries not over three inches long were found May 22, 1939, in Happy Hollow, west of Fort Collins, while in the North St. Vrain Canyon the first newly attacked trees were found June 22. The galleries in these trees were about 1 inch long.

Table I. Douglas fir beetle emergence in 1939 from trees hit 1938. North St. Vrain Canyon. Each cage of 2 square feet. Cages erected June 6.

Collection Date	Cage No. A			Cage No. B			Cage No. C			Totals Males	Totals ( )	Totals Females	Totals Both sexes	Percent of Total	Total to Date	Percent of Total to Date
	M.	( )	F.	M.	( )	F.	M.	( )	F.							
June 8	0		0	0	0	0	0		0							
10	0		0	0		0	0		0							
13	3		4	0	0	0	2		1	5		5	10	.65	10	6.3
15	2		3	0		0	14		12	16		15	31	2.03	41	25.9
17	0		0	1		2	6		8	7		10	17	11.11	58	36.7
19	1		5	0		2	6		4	7		11	18	11.76	76	48.1
21	3		2	0		0	0		1	3		3	6	.39	82	51.9
24	7		5	1		1	4		2	12		8	20	13.07	102	64.5
26	4		5	1		1	0		0	5		6	11	.71	113	71.5
28	2		8	0		0	0		0	2		8	10	.65	123	77.8
July 1	1		4	0		0	0		0	1		5	6	.39	129	81.6
3	0		2	0		0	0		0	0		2	2	.01	131	82.9
Aug. 16	0		0		(1)		1		0	1	(1)	0	2	.01	133	84.2
22								(1)			(1)		1	.01	134	84.8
24	0		0	0		0		(1)			(1)		1	.01	135	85.4
Nov. 1	1	(5)	4	3	(1)	8	0		0	4	(6)	12	22	13.9	157	99.4
16							1		0	1		0	1	1.01	158	100.0
Totals	24	(5)	42	6	(2)	14	34	(2)	29	64	(9)	85	158			

Sex ratio: 1:1.33 or 57% females and 43% males.
Average emergence per square foot: 25.5
Minimum emergence per square foot: 16.0
Maximum emergence per square foot: 34

M.--Male; F.--Female; ( )--Sex undeterminable.

The table shows that slightly more than 80 percent of the beetles emerging in 1939 emerged by July 4 and that many of the remaining beetles to emerge that season emerged after August 24. No check was made of these trees late in the season to find out whether any living beetles were still in them, but it is probable that a few were. The writer has observed many completely faded trees in April, in which a small amount of brood could be found. As far as could be determined these trees had been attacked two years earlier. At first it was believed that the parents of these beetles had attacked a green strip in a tree which had otherwise been filled in by beetles the year before. Later evidence indicated that this was not the case but that these beetles had in all probability been in the tree two years.

Sex ratio

The sex ratio of the emerging new adults was 1:1.34 (Table I).

Attacks

Pitch tubes are not formed at the point of attack of the Douglas fir beetle in Douglas fir. Under outbreak conditions many thrifty young trees are attacked and these attacks, especially the first ones, cause a copious flow of pitch which often streams down the trunk for several feet but typical pitch tubes are not formed. Why they are not is hard to explain since pitch tubes are formed when the Black Hills beetle makes occasional aberrant attacks in Douglas fir.

Counts of the attacks per square foot and gallery lengths were made for only a few trees. These counts are given below:

Attacks per square foot	Year of attack	
	1938	1939
Mean	11.7	8.6
Maximum	19	11
Minimum	8	6
Basis (sq. ft.)	15	9
Gallery length		
Mean	9.5"	5.6"
Maximum	14.5"	13.4"
Minimum	8.5"	2.4"
Basis (Number of galleries)	169	79

Egg Period

Eggs were found as late as August, as would be expected with emergence occurring all season long. Under field conditions the average incubation period of 25 eggs was 14.2 days; the shortest period was 9 days, longest 18 days.

Number of eggs laid and egg disposition

The eggs are laid in groups occasionally as large as 10 to 20 on the sides of a gallery alternately; they have never been observed opposite each other. Counts of 64 galleries indicate that the average number of viable eggs per gallery is about 39. The number ranged all the way from 8 eggs in a gallery less than 3 inches long which had apparently been abandoned, to 99 eggs in a gallery 10.5 inches long. The disposition of the eggs in the galleries is shown in table II. These figures are based on counts of 67 galleries.

Table II. Egg disposition by the Douglas fir beetle

	Number of eggs per gallery
1st inch	1.9
2nd "	11.4
3rd "	10.4
4th "	10.4
5th "	6.9
6th "	7.5
7th "	4.9
8th "	5.9
9th "	7.7
10th "	7.0
11th "	1.5
12th "	--

There appears to be a straight line relationship between the number of eggs laid per gallery and its length, the greater the length the greater the number of eggs laid, but, as is shown by the above table, the greatest number are laid in the second, third, and fourth inches.

Parent Beetle Emergence

Parent beetle emergence appeared to be negligible the past season. The little emergence that did occur was between July 17

and August 16, 1939. Seven cages were erected covering 33 square feet of bark surface, from which 18 parent adults emerged.

Associated Insects

Few associated insects were collected from either the cages on trees hit in 1938 or those on the trees hit in 1939. Since so few species were secured they are listed below:

Insect	Number emerging from "New adult" cages (6 sq. ft.)	Number emerging from "Parent adult" cages (33 sq.ft.)
Clerid larvae	21	15
Enoclerus lecontei		1
Hylastes Hopk.U.S. 31559-M	3	
Gnathotrichus aciculatus Hopk.U.S.31559-G	2	6
Xyleborus Hopk.U.S.31559-C	5	
Scolytus wickhami	1	1
Plegaderus "obesus" Hopk.U.S.31559-D	1	
Epurea	1	
"Carpophilus" Hopk.U.S.31559-A	1	
Othnius larvae	2	3
Orthoperid Hopk.U.S.31559-B	1	
Rhizophagus dimidiatus		1
Staphylinid (fragment)	1	
Cantharid larva	1	
Temnochia virescens var.	1	
Tenebroides	2	
Lasconotus "intricatus" Hopk.U.S.31559-I	1	
Corticeus larva	1	
Corticeus adults, Hopk.U.S.31559-E & E-1	6	4
"Aphanotus" Hopk.U.S.31559-F	1	
Pachyceras eccoptogastri		1 female
Coeloides "brunneri"	1 female	
Raphidid larvae		2
Phalangid	1	
Xysticus		1
	54	34

Melanophila, Tetropium, and Pseudohylesinus were commonly collected on the bark of newly attacked trees but none was secured from any of the tree cages.

SUMMARY

Emergence of new adult Douglas fir beetles occurred the entire summer; some beetles apparently will also hang over in the trees until the spring of 1940. By July 4 over 80 percent of the beetles which emerged the past season had left their host.

Average emergence per square foot was 25. The sex ratio of the emerging beetles was 1 male to 1.34 females.

First new attacks were observed May 22. Attacks per square foot in 1938 were 11.7; in 1939 they averaged 8.6. The average gallery length in 1938 was 9.5 inches; in 1939 it was 5.6 inches.

The average incubation period for 25 eggs was 14 days; the average number of eggs laid per gallery was 39.

Parent beetle emergence was negligible the past year; 1 beetle emerged for about every two square feet of bark surface.

Respectfully submitted,

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